MOISTURE CONTENT OF THE SEWAGE SLUDGE DRIED USING THERMAL DRYER

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ABSTRACT
Recently, the world’s dependence on conventional fuels as the primary source of energy and the environmental impact as a consequence of utilizing these fuels, it is found that the use of renewable energy is in urgent need at the present time. Currently, utilization of biomass residue as a source of energy is becoming very promising as it not only reduces the dependence on fossil fuels and the related environmental impact but also assist in solving the long-term problems related to the disposal of these materials. The problem with as-received biomass residue is, however, the difficulty of use as a source of energy due to its high moisture content, low density and issues related with handling, storage and transportation. One of the ideal solution to dispose the sludge is by converting it into useful energy in form of solid fuel such as pallet and briquette. This solution not only solve the sludge disposal problem but also generate energy to mankind. However, the main problem faced in order to convert this sludge into energy is it contains high moisture content which is more than 90% of moisture content. In order to convert it into useful energy, the moisture content of the sludge need to reduce into acceptable level which is below 20%. One of the method to remove the moisture content is by using thermal dryer. This paper discussing about the moisture content of the sewage sludge dried using the thermal dryer. The preliminary result obtain from the research found that the moisture content of the sewage sludge can be reduce up to 10.82% depending on the speed and the temperature of the dryer.

Keywords: sewage sludge, thermal dryer, solid fuel, moisture content, energy.

INTRODUCTION
Energy demands in Malaysia are increasing sharply due to the growth of population and economy. Malaysia as a developing country has achieved the population of 27.4 million in 2007 and expected to reach 33.4 million and 37.4 million by the year of 2020 and 2030 respectively when considering the average of 1.8% growth rate yearly [1]. The situation of economic growth and population leads to an increasing of energy demands, whereby some changes happened in the energy consumption pattern which influenced by the tremendous demands from transportation, industry, commercial and residential sectors. It was reported recently that the generation of domestic wastewater sludge (DWS) recorded a 64.4% share in the total solid waste generation in Malaysia surpassing Municipal Solids Wastes (MSW) [2]. This increase is indirectly elevating local environmental problems and special treatment will need to be employed to manage these waste due to its toxic and potentially harmful nature [3]. The management of DWS residue will also slowly increase the financial burden of wastewater treatment companies in Malaysia. This is especially critical when the population increases, as is faced in many urban and suburban areas in Malaysia [4]. One of the ideal solution is to convert the sewage sludge into useful solid fuel such as pallet as briquette. In order to convert the sewage sludge into useful fuel, the moisture content of the sewage sludge must be below than 20% [5]. Therefore, the thermal dryer was using in order to reduce the moisture content of the sewage sludge into the acceptable level and converting into useful solid fuel.

METHODOLOGY
The thermal dryer consists of 2 main component which is dryer and feeder. The electric motor will drive the screw conveyer in feeder to transport the wet sewage sludge into the dryer continuously. There are 5 variable speeds that available for the electric motor that driven the screw conveyer in the feeder and the dryer. The proposed thermal dryer as presented in the Figure-1.

![Figure-1. Proposed thermal dryer.](image-url)
the sewage sludge was subjected to fully drying in the oven for 24 hours with temperature of 110º. The moisture contents of the samples were measured using a CARBOLITE 450 electric oven according to ASAE S358.2 Standard. According to ASAE S358.2 Standard the moisture content in wet basis was calculated as follows:

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MC(w) = \frac{\text{Loss in Weight} \times 100}{\text{Weight of Wet Sample} \times 100}
\]

The electric motor will drive the screw conveyor in feeder to transport the wet sewage sludge into the dryer continuously. There are 5 variable speeds that available for the electric motor that driven the screw conveyor in the feeder and the dryer.

The electric motor used to drive the screw conveyor in feeder has 1420 round per minutes (RPM) at 50 Hz. The inverter was used in order to reduce the speed of the electric motor. The graph of variable frequency RPM of the electric motor in the feeder as presented in the Figure-2.

**Figure-2.** The rotation of the feeder for thermal dryer.

**RESULT AND DISCUSSION**

Figure-3 represents the moisture content of the sewage sludge with various power ratings and speed of screw conveyor in the dryer. The highest moisture content for this condition was at power rating of 135 kW and 10.19 RPM of the screw conveyor in the feeder which is 54.05 %.

The lowest moisture content for this condition was at power rating of 310 kW and 2.04 RPM of the screw conveyor in the feeder which is 10.82 %. Since the acceptable level of moisture content for the sewage sludge was 20 %, there are 13 samples of sewage sludge that have the moisture content about 20 % and below for this operating condition. The conclusion that can be made for this graph was the power rating must be higher than 240 kW in order to obtain the production of sewage sludge with less than 20% of moisture content.

**CONCLUSIONS**

The proposed thermal dryer successfully reduced the moisture content of the sewage sludge into acceptable level which is below than 20% for conversion into solid fuel. The highest speed of the screw conveyor in the dryer required high power of burner in order to supply enough heat for obtaining sewage sludge with less than 20% moisture content.

**REFERENCES**


